

Subject: GSC005 High voltage line overhead ground wire.

Application Areas

Perimeter: *Global*
Staff Function: -
Service Function: -
Business Line: *Enel Grids*

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THE HEAD OF NETWORK COMPONENTS
Fabrizio Gasbarri

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1. DOCUMENT AIMS AND APPLICATION AREA

The aim of this document is to provide technical requirements for the supply of ground wires, including optical ground wires (OPGW), to be used on transmission lines of the Enel Group Companies listed below:

Country	Distribution Company
Argentina	Edesur
Brasil	Enel Distribuição Rio Enel Distribuição Ceará Enel Distribuição Goiás Enel Distribuição São Paulo
Chile	Enel Distribución Chile
Colombia	Codensa
España	e-distribución redes digitales
Italia	e-distribuzione
Perú	Enel Distribución Perú
Romania	Enel Distributie Banat Enel Distributie Dobrogea Enel Distributie Muntenia

Table 1 - Distribution Companies

1.1 RELATED DOCUMENTS TO BE IMPLEMENTED AT COUNTRY LEVEL

This document applies to both Enel Grids Srl Company and to Enel Grids Business Line perimeter when each Company does not have to issue further documents.

2. DOCUMENT VERSION MANAGEMENT

Version	Date	Main changes description
1	12/07/2022	Issuing of "GSC005 High voltage line overhead ground wire" technical specification

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3. UNITS IN CHARGE OF THE DOCUMENT

Responsible for drawing up the document:

- Enel Grids: Engineering and Construction / Components and Devices Design / Network Components.

Responsible for authorizing the document:

- Enel Grids: Head of Network Components unit.
- Enel Grids: Head of Quality unit.

4. REFERENCES

- Code of Ethics of Enel Group;
- Enel Human Right Policy;
- The Enel Group Zero Tolerance of Corruption (ZTC) Plan;
- Organization and management model as per Legislative Decree No. 231/2001;
- RACI Handbook Infrastructure and Networks no. 06;
- Enel Global Compliance Program (EGCP);
- Integrated Policy of Quality, Health and Safety, Environment, anti-Bribery and Information Security;
- Policy n. 332 Global Infrastructure and Networks Design and construction HV lines guidelines;
- ISO 9001:2015 - Quality Management System - Requirements;
- ISO 14001:2015 - Environmental Management System - Requirements and user guide;
- ISO 45001:2018 - Occupational Health and Safety Management System - Requirements and user guide;
- ISO 50001:2018 - Energy management systems - Requirements with guidance for use;
- ISO 37001:2016 - Anti-bribery Management System - Requirements with guidance for use;
- ASTM B230 - Standard Specification for Aluminum 1350-H19 Wire for Electrical Purposes.
- ASTM B398 - Standard Specification for Aluminum-Alloy 6201-T81 Wire for Electrical Purposes.
- ASTM B415 - Standard Specification for Hard-Drawn Aluminum-Clad steel Wire.
- ASTM B416 - Standard Specification Concentric-Lay-Stranded Aluminum-Clad Steel Conductors.
- EN 50182 - Conductors for overhead lines - Round wire concentric lay stranded conductors
- EN 60889 - Hard-drawn aluminium wire for overhead line conductors.
- EN 61232 - Aluminium-clad steel wires for electrical purposes.
- IEC 60050-466 International Electrotechnical Vocabulary (IEV) - Part 466: Overhead lines
- IEC 60793-2 Optical fibres – Part 2: Product specifications – General.

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- IEC 60793-2-50 Optical fibres – Part 2-50: Product specifications – Sectional specification for class B single-mode fibres.
- IEC 60794-4 Optical fibre cables – Part 4: Sectional specification – Aerial optical cables along electrical power lines.
- IEC 60794-4-10 Optical fibre cables – Part 4-10: Family specification – Optical ground wires (OPGW) along electrical power lines.
- IEC-TR 61597 Overhead electrical conductors - Calculation methods for stranded bare conductors

5. ORGANIZATIONAL PROCESS POSITION IN THE PROCESS TAXONOMY

Value Chain/Process Area: Engineering & Construction

Macro Process: Devices and Components Development

Process: Standard Catalog Management

6. DEFINITIONS AND ACRONYMS

Acronym and Key words	Description
International Telecommunication Union (ITU)	United Nations specialized agency for information and communication technologies – ICTs
Maximum allowable tension (MAT)	Maximum tensile load that may be applied to the cable without detriment to the tensile performance requirement
Maximum installation tension (MIT)	Maximum recommended stringing tension during installation
Optical fiber (OF)	Thin flexible fibre with a glass core through which light signals can be sent with very little loss of strength.
Optical Ground Wire (OPGW)	A ground wire that includes optical fibers to provide a communications link
Rated Tensile Strength (RTS)	Summation of the product of nominal cross-sectional area, nominal tensile strength and stranding factor for each load bearing material in the cable construction

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<p>Technical Conformity Assessment (TCA)</p>	<p>A “conformity assessment”^a with respect to “specified requirements”^b consists in functional, dimensional, constructional and test characteristics required for a product (or a series of products) and quoted in technical specifications and quality requirements issued by Enel Group distribution companies. This also includes the verification of conformity with respect to local applicable regulation and laws and possession of relevant requested certifications</p>
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7. DESCRIPTION

This standard specifies the functional and construction characteristics and test requirements that must be accomplished by the ground wires made of steel wires and optical ground wires to be used on high voltage overhead lines with rated voltage above 36 kV.

Ground wires are used for the protection of electrical power lines against atmospheric discharges or short-circuits. When provided with optical fibers (OPGW), at the same time, they are used as a high bandwidth transport media for communications-and-control optical signals.

If necessary, conductors intended for other uses may be used as ground wires for protection against atmospheric discharges. In these cases, the standard of reference is not GSC005 but that of the conductor used. As an example, aluminum conductors steel reinforced (ACSR) from standard GSC003.

This standard replaces all the local standards used up to now by all the Distribution Companies, as long as local regulation allows it.

7.1 LIST OF COMPONENTS

This standard includes ground wires of the following types:

- Type GW: bare concentric-lay-stranded conductors made from bare, hard-drawn, round, aluminum-clad steel wires of 20.3% conductivity.
- Type OPGW: bare conductors containing optical fibers with telecommunications capabilities. They consist of one or more layers of wires stranded about a cable core that includes optical fiber units.

The list of ground wires with the main requirements, which is an integral part of the present document, is reported in the GS Type Code Lists on Annex B, and their relationship with country codes is reported on the Common List on Annex C. In **Table 2** the list of ground wires is shown.

^a Definition 2.1 of ISO/IEC 17000

^b Definition 3.1 of ISO/IEC 17000

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GSC005 Type Code	Type	Denomination GSC005	FO
GSCH005/01	GW	47-A20SA	-
GSCH005/02	GW	58-A20SA	-
GSCH005/03	GW	74-A20SA	-
GSCH005/04	GW	93-A20SA	-
GSCH005/05	GW	100-A20SA	-
GSCH005/06	GW	81-A20SA	-
GSCH005/11	OPGW	OPGW 11 kA 48 FO	48 B652
GSCH005/12	OPGW	OPGW 17 kA 48 FO	48 B652
GSCH005/13	OPGW	OPGW 21 kA 48 FO	48 B652
GSCH005/14	OPGW	OPGW 25 kA 48 FO	48 B652
GSCH005/21	OPGW	OPGW 11 kA 36+12 FO	36 B652 + 12 B655
GSCH005/22	OPGW	OPGW 17 kA 36+12 FO	36 B652 + 12 B655

Table 2 – List of GSC005 Type Codes for ground wires

The base unit of measure for all type of ground wires is meter (m).

7.2 DESIGN AND MANUFACTURE

7.2.1. Steel Ground wires

Ground wires without an optical fiber unit are concentric-lay-stranded aluminum-clad steel conductors according to EN-50182.

They use steel wires type A20SA according to EN61232 or type 20,3% conductivity according to ASTM B415 stranded with a lay ratio greater than 10 and smaller than 16 for each layer.

The direction of lay of the external layer shall be left-hand (S).

Mechanical and electrical characteristic are those in **Table 3**.

GS Type Code: GSC005/	/01	/02	/03	/04	/05	/06
Designation	47-A20SA	58-A20SA	74-A20SA	93-A20SA	100-A20SA	81-A20SA
Number of wires	7	7	7	7	19	7
Diameter of wires (mm)	2,91	3,26	3,67	4,11	2,59	3,83
Overall diameter (mm)	8,73	9,78	11,01	12,33	12,95	11,49
Cross-sectional area (mm ²)	46,56	58,43	74,05	92,87	100,10	80,65
Mass per unit length (kg/Km)	309,87	388,89	492,86	618,13	668,91	536,77
Rated Tensile Strength (daN)	6.238	7.654	9.256	10.959	13.414	9.000

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GS Type Code: GSC005/	/01	/02	/03	/04	/05	/06
Designation	47-A20SA	58-A20SA	74-A20SA	93-A20SA	100-A20SA	81-A20SA
DC resistance at 20°C (Ω/km)	1,84	1,466	1,157	0,922	0,859	1,062
Modulus of elasticity (kN/mm ²)	160					
Coefficient of linear expansion (°C ⁻¹)	0,0000126					

Table 3 – Characteristic of ground wires type GW

7.2.2. Optical Ground wires

Optical ground wires include an optical fiber unit formed by an aluminum tube or a stainless-steel tube with an aluminum protective coating to house and protect the optical fibers. This optical fiber unit shall protect the optical fibers from damage due to mechanical, thermal and electrical influences and moisture penetration. The tube may be fabricated as a seamless or seam-welded tube with means to avoid water penetration.

Stranded about the cable core may be aluminum, aluminum alloy or aluminum-clad steel wires or a combination of them to fulfil mechanical and electrical requirements indicated on **Table 4**.

Those wires shall be of one of the following types:

- Aluminium-clad steel wires from EN61232
- Aluminium alloy wires from EN50183 or ASTM B398
- Aluminium wires from EN60889 or ASTM B230
- Other wires may be used as an alternative, provided that they have the prior acceptance of Enel.

The finished wires shall contain no joints or splices.

The direction of lay of the external layer shall be right-hand (Z)

Mechanical and electrical characteristics for OPGW are those indicated on **Table 4**:

GS Type Code	GSC005/11	GSC005/12	GSC005/13	GSC005/14	GSC005/21	GSC005/22
Designation	OPGW 11kA 48FO	OPGW 17kA 48FO	OPGW 21kA 48FO	OPGW 25kA 48FO	OPGW 11kA 36+12FO	OPGW 17kA 36+12FO
Number of fibers	48 B.652				36 B.652 + 12 B.655	
Icc (0,3s, 40°C) (kA)	11	17	21	25	11	17
Fault current capacity (kA) ² s	36,3	86,7	132,3	187,5	36,3	86,7
Lightning resistance (Coulomb)	50	100	150	150	50	100
DC resistance at 20°C (Ω/km)	<0,65	<0,45	<0,35	<0,26	<0,65	<0,45
Overall diameter (mm)	<11	<14	<15	<17	<11	<14
Mass (kg/Km)	<400	<500	<550	<700	<400	<500

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GS Type Code	GSC005/11	GSC005/12	GSC005/13	GSC005/14	GSC005/21	GSC005/22
Designation	OPGW 11kA 48FO	OPGW 17kA 48FO	OPGW 21kA 48FO	OPGW 25kA 48FO	OPGW 11kA 36+12FO	OPGW 17kA 36+12FO
Rated Tensile strength (daN)	>4.000	>5.500	>7.400	>7.400	>4.000	>5.500
MAT (daN)	>2.400	>3.300	>4.400	>4.400	>2.400	>3.300
MIT (daN)	>1.400	>2.000	>2.700	>2.700	>1.400	>2.000

Table 4 – Characteristic of ground wires type OPGW

For any other characteristic, optical ground wires shall meet requirement from IEC 60794-4-10.

7.2.3. Optical Fibers

Fiber optics included on optical fiber units of OPGW are class B single-mode fibers according to requirements of IEC 60793-2-50:2018 of one of the types indicated below, or a combination of them:

- B-652.D: dispersion unshifted single-mode fibers designated as G.652.D on ITU-T recommendations
- B.655: non-zero dispersion shifted single-mode fibers designated as G.655 on ITU-T recommendations

7.2.4. Optical Fiber Unit

Inside an optical fiber unit there are 48 fiber that may be individually identified along all the length of the OPGW. They could be directly located in the metallic tube or grouped inside four dielectric loose buffer tubes around a structural member made of non-conductive dielectric materials.

If necessary, to avoid water penetration, a suitable filling compound shall fill the tubes.

For identifying the fiber, they shall be colored with twelve different colors, in accordance with **Table 5**, that are repeated for every group of twelve fibers.

Fiber Number	1	2	3	4	5	6	7	8	9	10	11	12
Fiber Color	Blue	Orange	Green	Brown	Grey	White	Red	Black or Natural	Yellow	Violet	Pink	Aquamarine

Table 5 – Color code for identifying fibers inside every group

If fibers are grouped inside loose tubes, the color of the tube identifies its order. When directly located in the metallic tube, fibers of group 2, 3 and 4 are striped with black (except black, which is striped with yellow), in accordance with **Table 6**.

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Group order	Color of loose tube	Stripes on fiber group		Fiber number
1	Blue	0		From 1 to 12
2	Orange	1	-	From 13 to 24
3	Green	2	=	From 25 to 36
4	Brown	3	≡	From 37 to 48

Table 6 – Code for identifying groups of fibers

For OPGW with different types of fibers (GSC005/21 and GSC005/22), fibers type B.652 are placed from number 1 to 36 and fibers type B.655 from 37 to 48.

In no case are fibers of different types placed together within the same loose tube or group.

7.3 CONDITIONS OF SUPPLY

Ground wires shall be tightly and uniformly wound onto reels in layers. Reel lengths are specified on the purchase order and each reel shall contain one continuous length of wire.

The reel shall withstand normal shipping, handling, storage, and stringing operations without damage to the ground wire. It must allow handling both during and after transport, by truck, crane or forklift truck, without causing damage to the ground wire.

The reel shall be made of wooden or steel and protected with staves or similar protection.

For OPGW type, the outer layer shall be protected by a water resistance wrapping over the exposed surface to prevent contact with dirt and gritty material.

The ground wire end shall be securely fastened to prevent the cable to becoming loose during shipment.

Both the outer and the inner ends of the length must be secured to the reel and accessible.

In case of OPGW type, the ends shall be accessible for connection to optical measuring equipment and sealed to prevent the entrance of moisture into the optical fibers or the escape of filling compound during shipment and storage. Two extra seals may be provided with each reel and shall be accessible without removing lagging.

7.3.1. Packing and marking

Each reel shall be identified with an indelible and easily legible mark on the outside of each flange.

Each reel shall be marked on the outside flange to indicate the direction the reel shall be rolled during shipment in order to prevent loosening of the cable on the reel.

All essential information shall be included on a weather resistant label on the outside of each flange. On the label there must be marked the following information:

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- a) GS Type Code and designation of the ground wire.
- b) Country Code and description of item.
- c) Manufacturer or brand.
- d) Supplier product designation as indicated on TCA.
- e) Order number or purchase order.
- f) Ordered and shipped lengths in meters.
- g) Gross, tare and net weight.
- h) Year and month of manufacture.

All information must be provided in the language of the country destiny of the supply.

7.3.2. Length tolerance

The admitted tolerance for a reel length of ground wire type GW is equal to $\pm 3\%$ of the length specified in the purchase order. The equipment used to measure the length of the conductor shall be accurate to $\pm 1\%$. For ground wire type OPGW a tolerance of $+2\%$ and -0% shall be maintained for the specified lengths.

7.4 TESTS

These tests shall be accomplished according to the requirements of this standard and those of TCA procedures.

7.4.1. Sample tests

Sample tests are intended to guarantee the quality of ground wires and compliance with the requirements of this standard. They could also be used as factory acceptance test.

Sample tests of ground wires, Type GW, shall be carried out as the procedures of EN 50182 and are shown in the Table 7 below.

Sample Tests		Clause EN50182
Conductor	- surface condition	6.4.1
	- diameter	6.4.2
	- inertness	6.4.3
	- lay ratio and direction of lay	6.4.4
	- number and type of wires	6.4.5
	- mass per unit length	6.4.6
Aluminium-clad Steel wires	- diameter	6.5.2
	- tensile strength	6.5.2
	- stress at 1 % extension	6.5.2
	- elongation	6.5.2
	- torsion	6.5.2

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Sample Tests		Clause EN50182
	- cladding thickness/uniformity	6.5.2
	- resistivity	6.5.2

Table 7 – Sample Test for Type GW

For optical ground wires, Type OPGW, sample tests for individual wires shall be carried out as the procedures indicated on their standard of reference, EN61232, EN 50718, EN 60889, ASTM B398, ASTM B230 or any other included on the OPGW design. Sample tests for conductor are listed below:

i) Design and visual inspection

It will be checked that the ground wire is that indicated on TCA documentation, that does not present any defects to the naked eye and that its elements dimensions correspond to those indicated in the technical data.

ii) Lay ratio and direction of lay

iii) Surface condition

iv) Diameter

v) Mass per unit length

vi) DC resistance of cable

vii) Breaking strength

viii) Color code for optical fiber unit

ix) Optical fiber attenuation coefficient at operational wavelength

7.4.2. Type Tests

Type test shall be carried out over ground wires considered in this Global Standard in order to verify its main characteristics.

Each manufacturer shall make these tests once and then subsequently repeated only when the design or manufacturing process is changed. The type test shall be analyzed using the requirements of this Global Standard and requirements of TCA procedures.

Type tests of ground wires, Type GW, shall be carried out as the procedures of EN50182 and are shown in the **Table 8** below. Additional test could be indicated for specific orders.

Type Tests		Clause EN50182
Conductor	- surface condition	6.4.1
	- diameter	6.4.2
	- inertness	6.4.3
	- lay ratio and direction of lay	6.4.4

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Type Tests		Clause EN50182
	- number and type of wires	6.4.5
	- mass per unit length	6.4.6
	- tensile breaking strength	6.4.8
Aluminium-clad Steel wires	- diameter	6.5.2
	- tensile strength	6.5.2
	- stress at 1 % extension	6.5.2
	- elongation	6.5.2
	- torsion	6.5.2
	- cladding thickness/uniformity	6.5.2
	- resistivity	6.5.2

Table 8 – Type Test for Type GW

Type tests of optical ground wires, Type OPGW, shall be carried out as indicated on IEC 60794-4-10:2014 paragraph 8.3 and are listed below. Additional test could be indicated for specific orders.

i) Tensile performance

ii) Stress-strain

This test must be carried out simultaneously with the tensile performance test.

The modulus of elasticity must be calculated during the third cycle.

iii) Breaking strength

The cable shall withstand without fracture of any wire not less than 95% of RTS declared by provider and not less than 100% of RTS indicated on **Table 4** for each GS Type Code.

iv) Sheave test

v) Aeolian vibration

vi) Creep

vii) Low frequency vibration test (Galloping)

viii) Temperature cycling

ix) Water penetration

Applicable to optical unit only (complete cable with all wires removed).

x) Short circuit test

The total short-circuit energy of each pulse to be impacted on the sample shall be equal to the value specified in **Table 4** for each GS Type Code.

xi) Lightning

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8. ANNEX

ANNEX A – TECHNICAL CHECK LIST

The following chart indicates the minimum technical information that suppliers shall provide in technical offer during tenders and as part of the TCA Type A documentation:

ANNEX A.1 – TECHNICAL CHECK LIST FOR GW TYPES

Item	Description	Unit	Required values	Ofered values
1	GENERAL INFORMATION			
1.1	Supplier Name	-		
1.2	Suplier CUI			
1.3	Factory	-		
1.4	Location of factory	-		
2	MAIN FEATURES			
2.1	Distribution Company and Country	-		
2.2	Country Code	-		
2.3	GS Type Code	-		
2.4	Enel designation	-		
2.5	Supplier product designation	-		
3	GROUND WIRE PROPERTIES			
3.1	Designation of steel wires	-		
3.2	Standard of reference for steel wires	-		
3.3	Number of wires	-		
3.4	Diameter of wires	[mm]		
3.5	Overall diameter	[mm]		
3.6	Cross-sectional area	[mm ²]		
3.7	Mass per unit length	[kg/km]		
3.8	Rated tensile Strength	[daN]		
3.9	DC Resistance at 20°C	[Ω/ km]		
3.10	Final Modulus of Elasticity	[KN/mm ²]		
3.11	Coefficient of linear expansion	[10 ⁻⁶ /°C]		
3.12	Direction of lay of external layer	-		
4	TCA			
4.1	There is an active TCA for this reference	YES/NO		
4.2	In case 4.1 answer is YES, indicate TCA Code	-		



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Item	Description	Unit	Required values	Ofered values
5	COMMENTS			
5.1	Any exception to what is required in GSC005	-		
5.2	Additional comments	-		

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ANNEX A.2 – TECHNICAL CHECK LIST FOR OPGW TYPES

Item	Description	Unit	Required values	Ofered values
1	GENERAL INFORMATION			
1.1	Supplier Name	-		
1.2	Suplier CUI			
1.3	Factory	-		
1.4	Location of factory	-		
2	MAIN FEATURES			
2.1	Distribution Company and Country	-		
2.2	Country Code	-		
2.3	GS Type Code	-		
2.4	Enel designation	-		
2.5	Supplier product designation	-		
3	OPGW PROPERTIES			
3.1	Overall diameter	[mm]		
3.2	Cross-sectional area (concerning mechanical calculations)	[mm ²]		
3.3	Mass per unit length	[kg/km]		
3.4	Rated tensile Strength	[daN]		
3.5	Final Modulus of Elasticity	[KN/mm ²]		
3.6	Coefficient of linear expansion	[10 ⁻⁶ /°C]		
3.7	DC Resistance at 20°C	[Ω/ km]		
3.8	Fault current capacity	[kA ² s]		
3.9	Short circuit current (0,3 s. Ti=40°C)	[kA]		
3.10	Final temperature for short circuit current on 3.9	[°C]		
3.11	Lightning resistance	[Coulomb]		
3.12	MAT-Maximum allowable tension	[daN]		
3.13	MIT-Maximum Installation tension	[daN]		
3.14	Strain margin of OPGW	[%]		
3.15	Maximum tension for strain margin of OPGW	[daN]		
4	OPGW DESIGN			
4.1	Number and type of fibers	-		
4.2	Optical Fiber Unit			
4.2.1	Nonconductive structural member material	-		
4.2.2	Nonconductive structural member diameter	-		
4.2.3	Nonconductive structural member strength	[daN]		
4.2.4	Number of loose tubes			

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Item	Description	Unit	Required values	Ofered values
4.2.5	Color of loose tubes			
4.2.6	Number of fibers on every loose tube			
4.2.7	Filling compound inside loose tubes			
4.3	Metallic Tube			
4.3.1	Inner diameter	[mm]		
4.3.2	Outer diameter	[mm]		
4.3.3	Stainless steel thickness	[mm]		
4.3.4	Aluminium thickness	[mm]		
4.3.5	Filling compound inside metallic tubes			
4.4	Aluminium-Clad steel wires			
4.4.1	Number of wires			
4.4.2	Nominal diameter of wires	[mm]		
4.4.3	Reference standard (and type)			
4.5	Aluminium alloy wires	[kg/km]		
4.5.1	Number of wires	-		
4.5.3	Nominal diameter of wires	[mm]		
4.5.4	Reference standard (and type)	[mm ²]		
4.6	Aluminium wires	[kg/km]		
4.6.1	Number of wires	-		
4.6.2	Nominal diameter of wires	-		
4.6.3	Reference standard (and type)	-		
4.7	Stranding	[mm]		
4.7.1	Number or layers	[mm ²]		
4.7.2	Lay ratio for every layer	[kg/km]		
4.7.3	Direction of lay of external layer	-		
5	ADDITIONAL FEATURES			
5.1	Allowable temperature range for storage, installation and operation	[°C]		
5.2	Minimum bending radius during installation	[mm]		
5.3	Minimum bending radius installed	[mm]		
6	TCA			
6.1	There is an active TCA for this reference	YES/NO		
6.2	In case 6.1 answer is YES, indicate TCA Code	-		
7	COMMENTS			
7.1	Any exception to what is required in GSC005			
7.2	Additional comments			

Subject: GSC005 High voltage line overhead ground wire.

Application Areas

Perimeter: *Global*
 Staff Function: -
 Service Function: -
 Business Line: *Enel Grids*

ANNEX B – GLOBAL TYPE CODES FOR GROUND WIRES AND OPTICAL GROUND WIRES

GS Type Code	Designation	N° wires / diameter (mm)		Nominal Cross Section (mm ²)	Overall diameter (mm)	Nominal d.c. resistance 20°C (Ω/km)	Mass per unit length (kg/Km)	Rated Tensile Strength (daN)
GSC005/01	47-A20SA	7	2,91	46,56	8,73	1,840	309,9	6.238
GSC005/02	58-A20SA	7	3,26	58,43	9,78	1,466	388,9	7.654
GSC005/03	74-A20SA	7	3,67	74,05	11,01	1,157	492,9	9.256
GSC005/04	93-A20SA	7	4,11	92,87	12,33	0,922	618,1	10.959
GSC005/05	100-A20SA	19	2,59	100,10	12,95	0,859	668,9	13.414
GSC005/06	81-A20SA	7	3,83	80,65	11,49	1,062	536,8	9.000

For all ground wire type GW:

Coefficient of linear expansion: 0,0000126 1/°C

Final Modulus of elasticity: 160 GPa

GS Type Code	Designation	Icc (0,3s, 40°C) (kA)	FO B652/ B655		Overall diameter (mm)	DC Resistance 20°C (Ω/km)	Mass per unit length (kg/Km)	Rated Tensile Strength (daN)	Maximum Allowable Tensile (daN)
GSC005/11	OPGW 11 kA 48FO	11	48	0	<11	<0,65	<400	>4000	>2400
GSC005/12	OPGW 17 kA 48FO	17	48	0	<14	<0,45	<500	>5500	>3300
GSC005/13	OPGW 21 kA 48FO	21	48	0	<15	<0,35	<550	>7400	>4400
GSC005/14	OPGW 25 kA 48FO	25	48	0	<17	<0,26	<700	>7400	>4400
GSC005/21	OPGW 11 kA 36+12FO	11	36	12	<11	<0,65	<400	>4000	>2400
GSC005/22	OPGW 17 kA 36+12FO	17	36	12	<14	<0,45	<500	>5500	>3300

Subject: GSC005 High voltage line overhead ground wire.

Application Areas

Perimeter: *Global*
 Staff Function: -
 Service Function: -
 Business Line: *Enel Grids*

ANNEX C – COMMON LIST

COMMON LIST				12/07/2022
GS Type Code	Designation	Distribution Company and Country	Country Code	TAM Description
GSC005/06	81-A20SA	EDI Italia	999902	CORDA ACC RIV AL D=11,5MM
GSC005/01	47-A20SA	EDRD España	310044	Cable de Tierra Acero recubierto Aluminio 47-A20SA
GSC005/02	58-A20SA	EDRD España	310045	Cable de Tierra Acero recubierto Aluminio 58-A20SA
GSC005/12	OPGW 17 kA 48FO	EDRD España	310043	Cable de tierra acero y fibra OPGW 17kA 48 FO
GSC005/01	47-A20SA	Enel Brazil	310044	CABO AÇO REV DE AL 47-A20SA, GSC005/01
GSC005/02	58-A20SA	Enel Brazil	310043	CABO AÇO REV DE AL 58-A20SA, GSC005/02
GSC005/03	74-A20SA	Enel Brazil	310042	CABO AÇO REV DE AL 74-A20SA, GSC005/03
GSC005/04	93-A20SA	Enel Brazil	310041	CABO AÇO REV DE AL 93-A20SA, GSC005/04
GSC005/05	100-A20SA	Enel Brazil	310040	CABO AÇO REV DE AL 100-A20SA, GSC005/05
GSC005/11	OPGW 11 kA 48FO	Enel Brazil	310038	CABO OPGW 11kA 48FO, GSC005/11
GSC005/12	OPGW 17 kA 48FO	Enel Brazil	310039	CABO OPGW 17kA 48FO, GSC005/12
GSC005/13	OPGW 21 kA 48FO	Enel Brazil	310037	CABO OPGW 21kA 48FO, GSC005/13
GSC005/14	OPGW 25 kA 48FO	Enel Brazil	310036	CABO OPGW 25kA 48FO, GSC005/14
GSC005/21	OPGW 11 kA 36+12FO	Enel Brazil	310035	CABO OPGW 11kA 36+12FO, GSC005/21
GSC005/22	OPGW 17 kA 36+12FO	Enel Brazil	310034	CABO OPGW 17kA 36+12FO, GSC005/22
GSC005/02	58-A20SA	Enel Chile	TBD	-
GSC005/14	OPGW 25 kA 48FO	Enel Chile	TBD	-
GSC005/13	OPGW 21 kA 48FO	Enel Perú	TBD	-
GSC005/02	58-A20SA	Enel Romania	310021	CONDUCTOR PROTECTIE OTEL ACOPERIT CU AL 58-A20SA, GSC005/02, UTILIZAT PENTRU LEGAREA LA PĂMÂNT A LINIILOR ELECTRICE AERIENE
GSC005/03	74-A20SA	Enel Romania	310020	CONDUCTOR PROTECTIE OTEL ACOPERIT CU AL 74-A20SA, GSC005/03, UTILIZAT PENTRU LEGAREA LA PĂMÂNT A LINIILOR ELECTRICE AERIENE
GSC005/04	93-A20SA	Enel Romania	310019	CONDUCTOR PROTECTIE OTEL ACOPERIT CU AL 93-A20SA, GSC005/04, UTILIZAT PENTRU LEGAREA LA PĂMÂNT A LINIILOR ELECTRICE AERIENE
GSC005/12	OPGW 17 kA 48FO	Enel Romania	310018	CONDUCTOR PROTECTIE OPGW, 17kA 48FO (FIBRE OPTICE) GSC005/12, UTILIZAT PENTRU LEGAREA LA PĂMÂNT A LINIILOR ELECTRICE AERIENE
GSC005/22	OPGW 17 kA 36+12FO	Enel Romania	310017	CONDUCTOR PROTECTIE OPGW, 17kA 36+12FO (FIBRE OPTICE) GSC005/22, UTILIZAT PENTRU LEGAREA LA PĂMÂNT A LINIILOR ELECTRICE AERIENE